

## REMARKS

Applicant respectfully requests that the above-identified application be reexamined.

The September 27, 2006, Office Action in the above-identified application ("Office Action") objected to Claims 22 and 32 because of incorrect dependencies. This amendment corrects the dependencies of Claims 22 and 32. As a result, applicant respectfully submits that this objection has been rendered moot and, thus, will not be further discussed.

The Office Action also rejected Claims 1-4, 10-11, 13-32, 34, 36-37, and 41-50 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,734,936, issued to Schadt et al. (hereinafter "Schadt '936").

Claims 6, 9, 33, 39, and 40 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the teachings of Schadt '936 taken in view of the teachings of U.S. Patent No. 5,678,863, issued to Knight et al. (hereinafter "Knight").

Finally, Claims 5, 7, 12, 35, and 38 were rejected under 35 U.S.C. § 103(a) as being unpatentable in view of Schadt '936 taken in view of U.S. Patent No. 6,582,776, issued to Yip et al. (hereinafter "Yip").

While applicant respectfully disagrees with the foregoing grounds of rejection, in order to advance the prosecution of this application, Claims 3, 24, and 38 have been canceled. Other claims have been amended in order for them to more particularly point out and distinctly claim the subject matter disclosed in this application. In addition, new Claim 51 has been added. For the reasons hereinafter set forth, applicant respectfully submits that all of the claims remaining in this application, as amended, are clearly allowable in view of the cited and applied references.

### **General Remarks**

Prior to discussing in detail why applicant believes all claims in this application are allowable, a brief discussion of the disclosed subject matter and a brief discussion of the main cited and applied reference (Schadt '936) and its interrelationship with the disclosed subject

matter are provided. These discussions are not provided to define the scope or interpretation of any of the claims in this application. Instead, these discussions are provided to help the United States Patent and Trademark Office better appreciate important claim distinctions discussed thereafter.

Polarizing liquid crystal devices that have at least one photo-alignment layer and a liquid crystal layer applied to the photo-alignment layer with a latent image comprising a pattern formed in at least one of the layers are disclosed. More specifically, improved liquid crystal devices and methods of manufacturing such devices in which the latent image is a pattern formed by image areas and/or non-image areas **written or printed** in at least one of the photo-alignment or liquid crystal layers without the use of a mask are disclosed.

The disclosed subject matter is a further development of the subject matter described in a number of patents owned by Rolic AG, including cited reference U.S. 6,734,936 (Schadt '936) and U.S. 6,160,597 (Schadt '597, which is equivalent to EP - A 689,084). Schadt '597 is acknowledged and discussed in the description of the present application. Collectively, these patents are hereinafter referred to as the "Rolic patents."

The Rolic patents relate to an optical element having at least one layer of a photo-oriented polymer network (PPN layer), and a layer of cross-linked liquid crystal monomers (LCP layer). The PPN layer is oriented in locally varying fashion and the molecular arrangement of the LCP layer is predetermined by the underlying photo-alignment layer. The LCP polymer layer is photo-cross-linked to fix the orientation.

The previous method of varying the orientation of the PPN layer in the Rolic patents involved exposure of the PPN layer to linearly polarized light for a prolonged period, e.g., five minutes, to align the molecules of the PPN layer and then, with a mask over part of the PPN layer, a further prolonged exposure with polarized UV light having a second polarization direction, to the parts of the PPN layer not covered by the mask. See the following parts of

Schadt '936: (a) Col. 6, lines 26-28 ("They are oriented and at the same time cross-linked by selective exposure to linearly polarized UV light."); (b) Col. 15, lines 12-16 ("the layer was then exposed to linearly polarized light, 200 W Hg high pressure lamp for 5 minutes at room temperature."); and (c) Col. 15, line 66 to Col. 16, line 4 ("The two halves of a PPN-coated glass plate were exposed to polarized UV light, the polarization direction of the light when illuminating the second half being rotated through (90 degrees) relative to the first exposure.").

Schadt '936, Col. 15, lines 9-14, describe applying the PPN layer by spin-coating a glass plate with a 5% solution of PPN material for one minute at 2000 rpm. The layer is then dried for one hour at 130 degrees C on a heating bench and for a further hour in a vacuum. Schadt '936 also refers to a multi-layer structure in which the number of PPN and LCP layers can be increased with layers separated by two crossed polarizer layers (Col. 7, lines 28-36). Lines 33-36 of Col. 7 state that "the central LCP layer arranged between the two polarizers can be produced according to the method disclosed in EP - A 689,084." EP - A 689,084, which is equivalent to U.S. 6,160,597 (Schadt '597), discloses an optical component and method of manufacture. In the described preferred method, a PPN layer is disposed on a substrate and either covers the entire substrate uniformly, or has varying local planar orientation (Col. 4, lines 58-61). The PPN layer is oriented and simultaneously cross-linked by selective irradiation with linearly polarized light (Col. 4, lines 64-65). Instead of the PPN layer, a conventional orientating layer may be used that is either a polyimide layer rubbed in one direction, or a layer having an orientating effect and obtained by oblique sputtering with SiO<sub>2</sub>. In this case, the orientating layer will usually have uniform orientation over the entire substrate surface (Col. 4, line 66 – Col. 5, line 7).

Although Schadt '597 mentions a PPN layer with regions 7 with a first orientation and regions 8 with a second orientation (Col. 5, lines 53-55), the only method of producing these regions of varying local orientation is disclosed in the Examples, and involves the PPN layer

being divided into two or three regions. During illumination of one region the other region(s) are covered. This is apparent from Col. 9, line 17 ("One half was covered during illumination of the other half;") and from Col. 10, lines 66-67 ("During illumination of each region, the other regions were covered").

Schadt '936 in conjunction with Schadt '597 (EP-A 689,084) only discloses, during each consecutive exposure, exposing different regions of selectively varying local orientation in a PPN layer to UV polarized light, the different regions determined by covering a mask. In contrast, the present application discloses a latent image comprising a pattern formed by writing or printing image areas and/or non-image areas in one or both of the photo-alignment layer and the liquid crystal layer. This can be accomplished in a single operation, either by laser writing the image or non-image areas, e.g., with a scribe laser, or in a single printing operation to form the image and/or non-image areas, thereby avoiding the need for the use of a mask and consecutive exposures as taught by Schadt '597 and Schadt '936.

**Rejection of Claims 1-4, 8, 10-11, 13-32, 34, 36-37 and 40-41 Under 35 U.S.C. § 102(e) as Anticipated by Schadt '936**

**Independent Claims 1 and 21**

The Office Action states that Schadt '936 discloses all the features of original Claims 1 and 21. Applicant disagrees. The Office Action does not reference any part of Schadt '936 that specifically states that no mask is used in the process for forming the latent image. In relation to independent method Claim 21, which mirrors product Claim 1, the Office Action refers to Col. 6, lines 29-41. This paragraph relates to photo-cross-linking the LCP layer using light of a suitable wavelength by means of which the molecular orientation of the LCP layer is fixed. The molecular orientation of the LCP layer is, however, pre-determined by the orientation of the underlying PPN layer (Col. 6, lines 30-31). The remainder of the paragraph, Col. 6, lines 35-41, refers to the use of an external polarizer for viewing the latent image and is not relevant to how

the latent image is actually formed in the PPN or LCP layer. Thus there is no disclosure in Col. 6, lines 29-41, of forming a latent image without use of a mask, let alone forming the latent image by writing or printing image areas and/or non-image areas in the PPN or LCP layer as now recited in Claims 1 and 21.

Col. 6, lines 20-28 of Schadt '936 mentions a PPN layer 3 whose orientation varies locally, e.g., imagewise (Col. 6 lines 21-23). However, the only mention of how the image may be formed is at lines 26-28, which states that the suitable materials are "oriented and at the same-time cross-linked by selective exposure to linearly polarised UV light." This is not a disclosure of "a latent image comprising a pattern formed by image areas and/or non-image areas written or printed in the at least one photo-alignment layer and/or in the liquid crystal layer without the use of a mask," as recited in amended Claim 1, and equivalently in Claim 21.

In summary, applicant submits that Schadt '936 does disclose all of the features of amended Claims 1 and 21 and, thus, these claims are not anticipated by Schadt '936 and are therefore allowable.

### **Independent Claims 2 and 23**

Regarding original Claim 2, the Office Action refers to Col. 8, lines 33-38, of Schadt '936 as disclosing "image areas and/or non-image areas written in the at least one photo-alignment layer and/or the liquid crystal layer." Applicant disagrees. Col. 8, lines 33-38, includes the statement: "a photograph can be broken down into a part permanently visible on a substrate, or an initially invisible part that is put in the retarder layer and cannot be seen unless a polarizer is used." This is not a disclosure of a latent image much less how the image or non-image areas of a latent image are formed. It clearly does not disclose image areas or non-image areas written in a PPN or LCP layer.

While applicant believes that Claim 2 was allowable as originally submitted, in order to advance the prosecution of this application, Claim 2 has been amended to include the feature of

previous Claim 3 and Claim 3 canceled. Specifically, Claim 2 has been amended to recite that the pattern forming the latent image is "laser written" into the photo-alignment (PPN) layer and/or in the liquid crystal layer. Regarding Claim 3, the Office Action refers to Col. 6, lines 26-28, and Col. 8, lines 61-65, as disclosing laser writing. Applicant disagrees. Col. 6, lines 26-28, only mention orientation and cross-linking at the same time by selective exposure to linearly polarized UV light, and Col. 8, lines 61-65, only refers to fluorescent molecules in an LCP layer that are exposed to polarized UV light. There is no disclosure in Schadt '936 of the use of laser radiation for writing image or non-image areas. As a result, applicant submits that Schadt '936 does not anticipate amended Claim 2 and, thus, that Claim 2 is allowable.

Regarding method Claim 23, which mirrors present Claim 2, the Office Action refers to Col. 6, lines 29-41, of Schadt '936 as disclosing writing image areas or non-image areas. However, as discussed above, Col. 6, lines 29-41, only disclose photo-cross-linking of an LCP layer and the use of an external polarizer for viewing a latent image. This is not a disclosure of the formation of a latent image by writing image or non-image areas, let alone laser writing such areas as recited in amended Claim 23. More specifically, while applicant believes that Claim 23 was allowable as originally drafted, in order to advance the prosecution of this application, Claim 23 has been amended to include the feature of previous Claim 24 and Claim 24 canceled. Regarding the feature of original Claim 24 incorporated into amended Claim 23, the Office Action refers to Col. 6, lines 26-28, as allegedly disclosing the use of a laser to write the image or non-image areas. Applicant disagrees. These lines only mention orientation and cross-linking by selective exposure to linearly polarised UV light. There is no mention of laser radiation. As a result, applicant submits that amended Claim 23 is clearly not anticipated by Schadt '936 and, thus, that Claim 23 is allowable.

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In summary, for the reasons given above, applicant submits that Schadt '936 does not anticipate amended independent Claims 2 and 23, both of which recite laser written image or non-image areas and, thus, that these claims are clearly novel and allowable.

#### **Dependent Claims 4 and 25-28**

Dependent Claims 4 and 25-28 depend from Claims 2 and 23 directly or indirectly and, thus, are submitted to be allowable for the same reasons that Claims 2 and 23 are allowable. These claims are also submitted to be allowable for additional reasons discussed below.

Dependent Claims 4 and 25 recite that the image areas and/or non image areas of the photo-alignment layer and/or the liquid crystal layer are removed by laser ablation. For example, a uniformly aligned photo-alignment layer may be applied over the substrate in the entire area of the device, and a laser used to ablate non-image areas in the photo-alignment layer (Claim 26). Then the liquid crystal layer may be applied to the non-ablated image areas remaining in the photo-alignment layer to form the pattern representing the latent image (Claim 27). Alternatively, the laser may be used to ablate non-image areas of the liquid crystal layer to leave non-ablated image areas in a pattern forming the latent image.

Regarding Claim 4, the Office Action refers to Col. 6, lines 26-28, and Col. 8, lines 61-65, of Schadt '936 as disclosing the removal of non-image areas and/or image areas by laser ablation. Applicant disagrees. Neither of those areas of Schadt '936 mention the use of a laser, let alone actually removing material of a layer by laser ablation.

Regarding Claims 25, 26 and 28, the Office Action refers to Col. 15, lines 66-67, and Col. 16, lines 1-4, of Schadt '936 as purporting to disclose a "laser used to remove image areas or non-image areas." Applicant disagrees. This paragraph of Schadt '936 reads as follows:

Two halves of a PPN-coated glass plate were exposed to polarized UV light, the polarization direction of the light when illuminating the second half being rotated through 90° relative to the first exposure. In each case,

the other half was covered during the exposure. This gave two regions with planar, mutually perpendicular orientation direction.

There is no mention in the foregoing paragraph of the use of a laser. Rather, the paragraph describes the exposure of two halves of a PPN layer to polarized UV light. More importantly, there is clearly no disclosure of laser ablation. Rather, two regions with planar, mutually perpendicular orientation directions exposed to polarized UV light are disclosed.

Regarding Claim 27, the Office Action refers to Col. 2, lines 7-12, of Schadt '936. This section of Schadt '936 refers to fixing the orientation of a PPN layer by a subsequent cross-linking step after which a cross-linked LCP layer is applied. Again, there is no mention of the use of a laser or laser ablation, or of applying a liquid crystal layer to non-ablated areas of a photo-alignment layer.

In summary, applicant submits that there is no disclosure in Schadt '936 of the use of laser ablation to remove image or non-image areas of a photo-alignment layer or a liquid crystal layer. Thus, Claims 4 and 25-28 are not anticipated by Schadt '936 and are submitted to be allowable for reasons in addition to the reasons why the claims from which these claims depend are allowable.

### **Dependent Claims 29-30**

Dependent Claims 29-30 depend directly or indirectly from Claim 23 and are submitted to be allowable for the same reason that Claim 23 is allowable. These claims are also submitted to be allowable for additional reasons that are discussed below.

Claim 29 relates to a method for writing image or non-image areas that uses a laser to change the photo-alignment state in specific image areas of a uniformly aligned photo-alignment layer. As will be appreciated by those skilled in the art and others, a laser produces a narrow beam of radiation that can be used to write the image or non-image areas by moving the laser over the particular areas of the uniformly aligned photo-alignment layer in which the alignment state is to be changed or reversed, or alternatively by moving a stage on which the substrate is

mounted relative to the laser beam. Such a process does not require consecutive exposures in which different parts of the photo-alignment layer are covered by a mask to form areas of different alignment or orientation as described at page 15, line 66, to page 16, line 4, of Schadt '936.

Regarding Claims 29-30, the Office Action refers to Col. 14, lines 12-14, of Schadt '936 as purportedly disclosing a UV laser used to change the photo-alignment state of a PPN layer. Applicant disagrees. Schadt '936 at page 15, lines 12-16, only discloses exposure of a PPN layer to linearly polarized light from a 200W Hg. High-pressure lamp for a prolonged period of 5 minutes at room temperature to set the orientation of the PPN layer. Such prolonged exposure to a mercury high pressure lamp is not the same as laser writing with a narrow laser beam, such as a UV laser having a wavelength of about 280 nm or less.

In summary, applicant submits that Schadt '936 does not disclose the use of a laser to write image areas or non-image areas by changing the alignment state of areas in a photoalignment layer as recited in Claim 29 or of using a laser with a wavelength as recited in Claim 30 and, thus, these claims are allowable for reasons in addition to the reasons why the claims from which these claims depend are allowable.

#### **Dependent Claim 32**

Applicant submits that Claim 32, which depends from Claim 21, is allowable for the same reason that Claim 21 is allowable. Claim 32 is also submitted to be allowable for additional reasons, which are discussed next.

The Office Action rejected Claim 32, which recites "the step of printing the latent image in at least one of the layers" as anticipated by Schadt '936.<sup>1</sup> The Office Action refers to Col. 7, lines 44-49, of Schadt '936 as the basis for rejecting Claims 32 as anticipated by Schadt '936. Applicant disagrees. There is no mention of printing either the photo-alignment layer or the LCP layer in this section, or in any other part of Schadt '936. Therefore, applicant submits that Claim 32 is not anticipated by Schadt '936, and, thus, is allowable for reasons in addition to the reasons why Claim 21 is allowable.

#### **Independent Claims 37 and 39**

Independent Claim 37 has been amended to incorporate the feature of previous Claim 38 and Claim 38 has been canceled. As amended, Claim 37 recites "printing a second photo-alignment layer in a pattern representing the latent image." (Emphasis added.) There is no mention of the printing of photo-alignment layers in Schadt '936. Since the Office Action did not reject Claim 38 as being anticipated by Schadt '936, applicant submits that amended Claim 37, which now incorporates the language of previous Claim 38, is not anticipated by Schadt '936 and, thus, is allowable thereover.

New independent Claim 39, which is a combination of previous independent Claim 37 and dependent Claim 39, recites that the "liquid crystal layer is printed on the second photo-alignment layer in the pattern representing the latent image." There is no mention of printing on the liquid crystal layer in Schadt '936. Since the Office Action did not reject

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<sup>1</sup> Applicant notes that the Office Action did not similarly reject Claims 7 and 9, which respectively claim that the "photo-alignment layer is printed on the substrate in the pattern forming the latent image" (Claim 7) and that "the liquid crystal layer is printed on the photo-alignment layer in the pattern forming the latent image" (Claim 9).

previous Claim 39 as anticipated by Schadt '936, applicant submits that amended Claim 39 is also not anticipated by Schadt '936 and, thus, is allowable thereover.

**Dependent Claims 8, 10-11, 13-20, 22, 31, and 41-50**

Applicant respectfully submits that Claims 8, 10-11, 13-20, 22, 31, and 41-50 are also not anticipated by Schadt '936 for the reasons discussed above with regard to the claims from which these claims depend. As a result, applicant respectfully submits that Claims 8, 10-11, 13-20, 22, 31, and 41-50 are also allowable.

**Summary**

In summary, applicant respectfully submits that all of the claims remaining in this group, namely, Claims 1, 2, 4, 8, 10-11, 13-23, 25-32, 34, 36-37, and 41-50 are clearly not anticipated by Schadt '936. Applicant further submits that the subject matter of these claims would not be obvious in view of the teachings of Schadt '936. More specifically, with respect to independent Claims 1, 2, 21, and 23, for example, Schadt '936 does not mention the use of a laser to write image areas or non-image areas of a pattern forming a latent image. Likewise, Schadt '936 does not disclose printing a pattern representing a latent image in either a photo-alignment layer or a liquid crystal layer. The only method disclosed by Schadt '936 of forming a latent image pattern with image areas and non-image areas is by covering one half of a PPN layer during a first exposure to polarized UV light, and to cover the opposite half during a second exposure to polarized light having a polarization direction rotated through 90 degrees. Independent Claims 1, 2, 21 and 23 recite laser writing. The Office Action has not cited any reference that discloses the use of a laser to write image or non-image areas in a PPN layer or in an LCP layer. Therefore, "obviousness" can only be assessed with regard to Schadt '936 *per se*. There is no discussion in Schadt '936 of any inadequacies in its method of forming latent images by covering different parts of the image area during successive to polarized light. Further, there is no teaching or suggestion in Schadt '936 that would lead or motivate a skilled person reading

Schadt '936 to consider a laser writing method for forming latent images. Applicant therefore submits that the laser writing aspect of independent Claims 1, 2, 21, and 23 as amended would not have been obvious to a person of ordinary skill in this art at the time the invention was made.

**Rejection of Claims 6, 9, 33, 39 and 40 Under 35 U.S.C. § 103(a) as Unpatentable in View of Schadt '936 and Knight**

Claims 6, 9, 33, 39, and 40, all of which are dependent claims except for Claim 39, are directed to forming latent images by printing the liquid crystal layer in the pattern forming the latent image. These claims have been rejected under 35 U.S.C. § 103(a) as unpatentable in view of Schadt '936 taken in view of Knight.

Knight discloses a document of value in which a liquid crystal material is applied over a watermark. A watermark is usually formed by variations in material density and/or thickness that produce variations in optical density (Col. 2, lines 37-39). Watermarks may be produced by "the well-known cylinder mould-made paper process" (Col. 2, lines 51-54), and by other means, e.g., "by printing or compression that produces a localised variation in optical density in a paper or polymer substrate." The liquid crystal material may be applied to the watermark either in solid form by a transfer process, or in liquid form by a printing process.

The Office Action states that Knight discloses a liquid crystal device similar to that of Schadt '936. Applicant disagrees. The watermark of Knight is quite different from the optical element of Schadt '936, which requires an orientation (PPN) layer on a substrate to interact with a liquid crystal polymer (LCP) layer to form a latent image that is viewable under cross-polarizers. A watermark is not a latent image; it can be viewed simply by holding the document up to a light source so that the viewer can observe the variation in optical density. Further, the colour changing effect produced by the alternating left-hand right-hand helical liquid crystals of Knight is only circularly polarising in reflection and can only be observed with a

circularly polarising detection system such as a waveplate and polarising element. In contrast, the latent image of the invention is completely hidden until viewed with cross-polarizers.

The Office Action also states that Knight discloses a liquid crystal device wherein "all liquid crystal layers are variably printed on the photo-alignment layer in the pattern forming the latent image." (Emphasis added.) Applicant disagrees. Knight does not disclose printing on a photo-alignment layer, let alone a printed liquid crystal layer that interacts with an underlying photo-alignment layer to form a latent image viewable under cross-polarizers. The Office Action refers to Col. 6, lines 49-57, of Knight to support this rejection. Again, applicant disagrees. This paragraph only discusses a crystal material in liquid form held within microcapsules applied to the watermark.

Further the result of applying the liquid crystal material to the watermark in Knight is to enhance the watermark, for instance by producing a varying colour effect in addition to the optical density variation of the watermark. In contrast, the liquid crystal polymer (LCP) layer of the present application is oriented by its interaction with the underlying PPN layer and is fixed by cross-linking to form the latent image.

Contrary to the Office Action's conclusion, applicant submits that it would not have been obvious to one of ordinary skill in the art to use the printing process of Knight in the method of manufacturing the device of Schadt '936. Knight does not teach or suggest that a printed liquid crystal layer would be suitable for application to a photo-alignment layer. Schadt '936 requires the application of cross-linkable liquid crystal (LC) monomers to a PPN layer so that the liquid crystals molecules adopt the orientation of the underlying PPN layer with the LC monomers being cross-linked to form and fix the LCP layer. In contrast, Knight discloses the application of encapsulated liquid crystal material to a watermark. In this case, the orientation of the liquid crystal molecules is pre-determined by the type of liquid crystal material used, i.e., having either a left-handed or a right-handed helical structure.

The Office Action suggests that a skilled person would have been motivated to use the printing process of Knight in the manufacturing process of Schadt '936, commenting that the motivation would have been to create more detailed images that could be applied in each layer making reproduction virtually impossible as taught by Knight (Col. 6, lines 53-66). Applicant disagrees. No motivation can be found in Schadt '936 to use a different method of forming the pattern of a latent image other than the disclosed method of selective exposures of the photo-alignment (PPN) layer with linearly polarized light of different polarization directions. Even if Knight were combinable with Schadt '936, which applicant denies, since they relate to different types of devices, i.e., a watermark, and an optical element requiring the interaction between a PPN layer and an LCP layer to produce a latent image, applicant submits that the motivation to combine their teachings can only be ascertained with the benefit of forbidden hindsight reasoning based on knowledge of the present invention.

In view of the above, applicant submits that it would not be obvious to combine the teachings of Schadt '936 and Knight to arrive at the subject matter recited in Claims 6, 9, 33, 39, and 40. Thus, except for independent Claim 39, these claims are submitted to be allowable for reasons in addition to the reasons why the claims from which these claims depend are allowable. Claim 39 is submitted to be allowable for the reasons discussed above.

**Rejection of Claims 5, 7, 12, 35 and 38 Under 35 U.S.C. § 103(a) as Unpatentable in View of Schadt '936 and Yip**

Dependent Claims 5, 7, 12, 35, and 38 (now independent Claim 37) all recite forming the latent image by printing at least one of the photo-alignment layers in a pattern representing the latent image. These claims have been rejected based on the teachings of Schadt '936 taken in view of the teachings of Yip.

Yip describes a method of manufacturing a photo-alignment layer in which a material containing a dichroic dye is applied to a substrate and exposed to polarized light and polymerised

by heating or light exposure. The photo-alignment layer can be applied to the substrate by a method such as spin coating. A printing method is briefly disclosed at Col. 7, lines 26-31, which can also involve drying a coating layer, then conducting a photo-alignment operation and the polymerization of the polymerisable group.

The photo-alignment layer of Yip is intended for use in a liquid crystal display (LCD) device in which the state of molecules alignment of liquid crystals is changed by the action of an electric field and a change in optical characteristics attending the change is utilised for display (Col. 1, lines 8-18). Although the liquid crystals in such a device may align their orientation in a steady state to the photo-alignment layer, when subjected to an electric field, their orientation changes so that the LCD device displays the correct image in accordance with the applied electric field.

In contrast to the photo-alignment layer for an LCD device disclosed in Yip, in the subject application the at least one photoalignment (PPN) layer is adapted to interact with a liquid crystal layer that is applied to the photo-alignment layer and cross-linked to fix the orientation of the liquid crystal layer to form a latent image that is suitable for incorporation in security documents and the like. Such a latent image is used to provide an indication of authenticity of the security document by viewing the latent image under cross-polarizers. This is not the same as a liquid crystal display (LCD) device in which the orientation of the liquid crystals changes under the application of an external electric field. In the present application, the orientation of the liquid crystal layer does not change after it has been fixed by the cross-linking step.

The Office Action states: "It would have been obvious to one of ordinary skill in the art at the time of the invention to use the printing method of Yip in the method of manufacturing the device of Schadt." Applicant disagrees. Yip discloses different applications. More specifically, Yip discloses a photo-alignment layer in an LCD device in which the orientation of the liquid

crystals changes upon application of an external electric field. Applicant submits that it would not have been obvious to the ordinary skilled person to use the printing method disclosed in Yip in the manufacture of a liquid crystal device that has a latent image formed by a liquid crystal layer that is fixed by cross-linking as taught by Schadt '936.

Claims 5, 7, and 12 are dependent upon amended Claim 1, and Claim 35 is dependent upon independent Claim 21. Both of those claims and amended independent Claim 39 recite that the latent image comprises a pattern formed by image areas and/or non-image areas written or printed in the at least one photo-alignment layer. Yip does not disclose the printing of image areas and/or non-image areas in a photo-alignment layer. Yip only discloses spin coating or printing a uniform coating of a photo-alignment layer on a substrate. Thus, even if the teachings of Schadt '936 and Yip were combinable, which applicant denies, the resulting combination would not result in the subject matter of Claims 5, 7, 12, 35, and 39.

The Office Action contends that Yip provides a motivation for using the printing method in the manufacturing method of Schadt '936, referring to Col. 3, lines 9-12, which refer to obtaining a photo-alignment layer that displays excellent long-term photochemical stability. Applicant disagrees. This advantage of a photo-alignment layer produced by the method of Yip is not provided by the printing method of Yip. Rather, the long term photochemical stability is provided by the presence of a dichroic dye having two or more polymerisable groups per molecule. The method by which the photo-alignment layer is applied to the substrate in Yip, i.e., the preferred method of spin coating discussed at Col. 13, lines 31-33, and Col. 13, lines 47-48, or the less preferred method of printing, which is only briefly mentioned at Col. 7, line 29, is not relevant to the long-term stability of the photo-alignment layer.

The motivation for the applicant to print the photo-alignment layer in image areas and/or non-image areas to form the pattern of the latent image was to enable detailed images, such as personal portraits, to be formed using variable printing technology, and to enable a wide variety

of latent images to be produced for use as security and authentication devices in security documents. This is quite different from the motivation suggested in the Office Action. Moreover, the brief mention of applying a photo-alignment layer to a substrate by a printing method in Yip, without discussing any advantages of a printing method over the spin coating method described in Col. 13, is not a teaching or suggestion that would motivate or lead the person of ordinary skill in the art to consider using the printing method mentioned in Yip, which relates to liquid crystal display (LCD) devices in the method of manufacturing an optical component providing a latent image of Schadt '936.

In summary, applicant submits that Claims 5, 7, 12, 35, and Claim 39 (corresponding to original Claims 37 and 38) would not have been obvious to a person of ordinary skill in the relevant art based on Schadt '936 in view of Yip. As a result, applicant submits that these claims are also allowable.

#### **New Independent Claim 51**

New independent Claim 51 essentially corresponds to a combination of previous Claims 21 and 40 and recites the step of: "forming a pattern representing a latent image by printing image areas or non-image areas in the at least one photo-alignment layer using a variable printing process without the use of a mask."

Yip does not disclose, teach or suggest the use of a variable printing process to print image areas or non-image areas in a photo-alignment layer. Instead, Yip only discloses the uniform coating of photo-alignment layer on a glass substrate. The preferred method of applying the uniform coating in Yip is to use a "spin coater," Col. 13, lines 31-32, and lines 47-48. The only disclosure of using a printing method is at Col. 7, line 29, and there is no teaching or suggestion that this printing method could be a variable printing method as opposed to applying a uniform coating. Nor does Schadt '936 or Knight disclose this subject matter. Applicant therefore submits that the recitations of new independent Claim 51 would not have been obvious

to a person of ordinary skill in the relevant art at the time the invention was made based on Schadt '936, Knight, or Yip, taken alone or in combination.

CONCLUSION

In view of the foregoing amendments and comments, applicant respectfully submits that all of the claims remaining in this application are clearly allowable in view of the teachings of the cited and applied references. Consequently, early and favorable action allowing these claims and passing this application to issue is respectfully solicited.

If the Examiner has any questions, he is invited to contact applicant's attorney at the number set forth below.

Respectfully submitted,

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